"Century-scale simulations of the response of the West Antarctic Ice Sheet to a warming climate" – D.F. Martin, E.Ng, LBNL, et al.

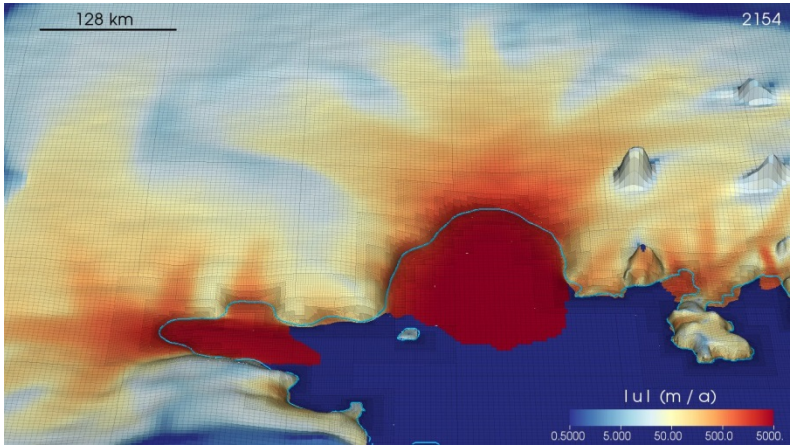
Objectives

- The 2007 & 2013 Intergovernmental Panel on Climate Change (IPCC) reports highlighted the need for better projections of the Antarctic contribution to sea-level rise (SLR)
- The West Antarctic Ice Sheet (WAIS) is particularly vulnerable due to marine forcing from warming oceans and because much of the WAIS sits on bedrock which is below sea level
- Use combinations of global and regional climate models to generate ensemble of climate forcing scenarios to examine likely WAIS response to potential future climate forcing
- Need high (sub-kilometer) resolution to fully resolve dynamics of marine ice sheet retreat in a large-scale simulation

Impact

- First fully process-based large-scale model projections of WAIS contributions to SLR, based on climate inputs from an ensemble of earth system models
- Used the Berkeley Adaptive Mesh Refinement (AMR) ice sheet model (BISICLES) to fully resolve dynamically important regions like grounding lines
- Resulting projections of future SLR from the WAIS are in general agreement with estimates from IPCC reports
- Response is dominated by the retreat of marine ice sheets in response to warm-water incursions under Antarctic ice shelves

Amundsen Sea Embayment Ice Sheet
after 200 Years of Retreat



Simulations conducted at the National Energy Research Scientific Computing Center (NERSC)

FY 2015 Accomplishments

- First application of BISICLES, a state-of-the-art, AMR ice sheet model, to large-scale projections of WAIS response to climate forcing
- AMR allows for full resolution of dynamically changing grounding lines in regional- and continental-scale simulations

"Century-scale simulations of the response of the West Antarctic Ice Sheet to a warming climate", Cornford, Martin, Payne, Ng, et al, The Cryosphere, 9, 1579-1600, doi:10.5194/tc-9-1579-2015, 2015.